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Effects of Selection Criteria and Economic Opportunities on the Characteristics of Immigrants

by Abdurrahman Aydemir

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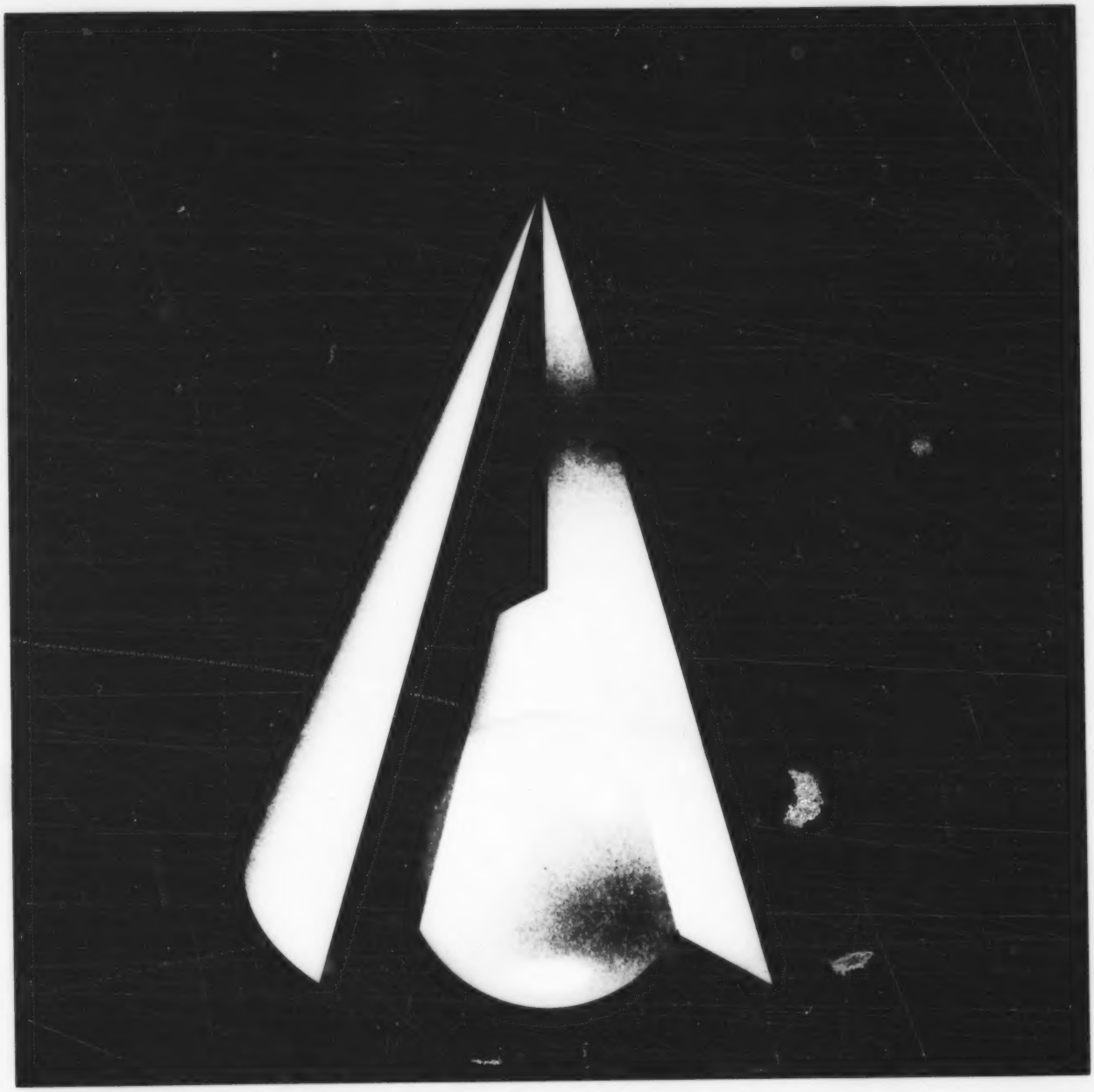

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Aussi disponible en français

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ABSTRACT

International migration is a joint outcome of individual's desire to migrate and the host country's selection process. The theoretical focus of the earlier literature was just on the desire to migrate, and the empirical literature focused on who actually migrates, which is the product of these two factors. The objective of this paper is to identify the components of this two-step decision making process by incorporating them in a model of migration that involves two steps. In the first step potential migrants apply to a host country and in the second step the host country chooses migrants from the applicant pool. Parameters in the model relate directly to policy instruments such as the points awarded for various characteristics. Given the parameter estimates of the model, general analysis of immigration policy, an analysis of the factors determining the decision of individuals to apply can be done in a way that hitherto has not been possible. Using samples of migrants and non-migrants, the model is estimated for migration from two different source countries, the U.S. and the U.K., to Canada. For migrants a newly available longitudinal data set the Longitudinal Immigration Database (IMDB) is used. The richness of this database, which follows immigrants to Canada over a long period and contains information on both their application and subsequent earnings, permits the investigation of a large range of questions that could not be fruitfully addressed before. Estimation of the two-step framework provides important insights on the effects of the factors that determine the two steps. For example, for both source countries, more educated are more likely to be observed as migrants, a fact that can be observed from a simple probit. However, the two-step method shows that, in contrast to those from the U.K., higher educated individuals from the U.S. are less likely to apply, but because of the policy stage the resulting migrants are more educated. This may be related to returns to education in the various countries, which has to be investigated in future. The host country's selection is also found to have significant impact on characteristics of the immigrants. This result indicates that parameters determining the desire of individuals to migrate cannot be properly identified without taking into account the impact of selection by the host country. Further analysis within this framework can address issues such as the effect of changes in the policy structure on migration outcomes, the effects of policies that indirectly affect migration via effects on net-of-tax wage rates.

Keywords: immigration, self-selection, points system, bivariate probit, partial observability

JEL: J61, J68

1. *INTRODUCTION*

There are two related questions of interest when studying international labour migration in the context of an immigrant receiving country. The first one is the impact of immigration on the economy, while the second one addresses the issue of how to set the level and composition of immigrants. This study focuses on the second issue. The aim of this paper is to understand the factors that induce individuals to decide to migrate in an international context which determines the pool of applicants for immigration, and the effect of selection of immigrants by the host country, and hence the effect of immigration policy, on the observed characteristics of migrants.

There is a large body of literature studying internal migration that is free of any constraints imposed by immigration policy as migration within a country is not restricted. However, in an international context both the selection of migrants by the host country and the decision of individuals to migrate jointly determine the characteristics of immigrant flows. Therefore, understanding the determinants of international migration requires taking into account both of these factors.

Immigrant receiving countries try to select the high quality migrants in the immigrant pool who possess skills that are in high demand in the host country. This is achieved through immigration policies that aim to control the skill distribution of incoming migrants. For example, under the current Canadian regulations, non-refugee immigrants are allocated to one of three broad admission classes: family class, independent class and assisted relative class. Applications under independent and assisted relative classes are assessed by a "point system". Points are awarded to applicants based on personal characteristics assumed to be associated with short and long run adaptation to the Canadian economy such as education, age, experience, and the demand for the intended occupation of the applicant.[1]

Other major immigrant receiving countries such as the United States and Australia also have policies that aim to control the skill distribution of migrants. Australia has a system similar to the Canadian point system. Although the United States does not have a point system, employers try to attract skilled immigrants through special visas allocated to different industries that have demand for skilled workers. Controlling the size and skill distribution of migrants became a major policy debate in the European Union as a result of increasing migration between member countries as well as migration from non-member countries to the European Union.

Immigration policies adopted by immigrant receiving countries such as the ones discussed above have potentially significant impacts on the immigration outcomes. It is, therefore, of major importance to estimate the impact of policy parameters on immigration.

The earlier theoretical literature studies the desire to migrate, while the focus of the empirical literature was on either who actually migrates or the impact of immigration policy. Both the

[1] Appendix 1 provides further information about the Canadian Immigration Policy and the point system as of 1986-1990 period.

theoretical work[2] and the empirical work[3] on the determinants of international migration ignore the impact of the host country's immigration policy on immigration outcomes. Lucas (1985) tries to assess the impact of individual characteristics on who emigrates. Borjas (1987) developed a self-selection model of migration based on the model of Roy (1951) that has been used extensively in the literature. This model assesses the impact of income inequality in the source countries on the skill content of migrants controlling for source country-specific aggregate variables that portray the political and economic conditions. Starting with Borjas (1987), implications of the Roy model were tested by various studies that yielded conflicting results.[4]

Greenwood and McDowell (1991), and Cobb-Clark (1993) note that immigration policy is not taken into account in this literature and they include variables in their reduced form equations on an ad hoc basis trying to capture these effects. Their results suggest that immigration policy is important in determining observed outcomes.

The other line of empirical research focuses on immigration policy in an attempt to identify the effects of policy on the skill levels of migrants. There are two approaches in studies of policy effectiveness. The first approach (e.g. Green and Green, 1995) focuses on a single immigrant receiving country, and identifies periods of different immigration policies. Variations in the level and composition of immigration are attributed to the policy changes. Although this approach can control for the changing national origin mix of immigrants over different periods, it is not possible to identify the individual effects of the policy changes from the changes in incentives to migrate. The second approach (e.g. Borjas, 1993) studies immigrant receiving countries that differ in their policies and attributes differences in outcomes to the different immigration policies. In this approach, usually censuses for each country are used, resulting in immigrants who entered a country under quite different policy regimes being inappropriately combined together. Also, in census data due to absence of information on the class of admission of immigrants conclusions cannot be drawn on specific parts of the immigration policy (e.g. the point system in a Canadian context).

This study establishes a framework that specifies migration as a two step process:

Step (1) **Application**: Potential migrants apply to migrate to a host country.
Step (2) **Review**: The host country chooses migrants from the applicant pool.

---

[2] For a review of theoretical models of migration see Bauer T. and K. F. Zimmerman (1995), Massey et al. (1993, 1994).

[3] See Lucas (1985), O Grada (1986), Taylor (1986), Adams (1993). The context of immigration is from less developed countries (LDC) to either developed countries or to another LDC.

[4] Borjas (1987) and Borjas (1993) focus on migration to the U.S. from different source countries. Ramos (1992), Ortiz (1986), Rivera-Batiz (1989), Gutierrez (1983), Sandis (1973), Hernandez-Alvarez (1967), Senior and Watkins (1975), Friedlander (1965), Melendez (1994) focus on migration between Puerto Rico and the U.S. Papers before Borjas (1987) are mostly motivated by the early brain drain literature. Because Puerto Ricans are U.S. citizens and can therefore move freely between the two "countries", size and composition of migrant flows can, in effect, be attributed entirely to differences in social and economic factors between the sending and receiving regions.

The observed differences in characteristics of immigrant flows across time and across source countries in terms of skill content, age and occupational distributions may be attributed to different incentives available to individuals in source and host countries that affect their desire to migrate or they may be a result of changing selection rules of the host country. Within the two-step framework of this study the impacts of these factors determining the two steps can be identified separately. This allows for predicting the effect of changing incentives or changes in demographic factors such as a change in age distribution on characteristics of applicants from a source country. Given a pool of applicants, the impacts of different selection rules can also be predicted. The focus of the previous empirical literature on who actually migrates, which is the product of application and review decisions has two major drawbacks. First, it precludes analysis of the effects of immigration policy on migration when changes in policy are accompanied with changing incentives to migrate. Second, by abstracting from the two step structure identification of the structural parameters of the application step and review step becomes impossible.

In the two-step framework of this study, using the selectivity-corrected returns to various characteristics for migrants and non-migrants, the 'opportunity wages' of individuals, that is, the wages of migrants had they stayed and non-migrants had they migrated can be estimated. This allows the estimation of the responsiveness of the individual's desire to migrate to the expected returns. The effects of policies that indirectly affect migration via effects on net of tax wage rates can also be addressed.

The model is estimated by pooling samples of male migrants and non-migrants, using the U.K. and the U.S. Census data for non-migrants and a new data set of migrants to Canada, the Longitudinal Immigration Database (IMDB). These data permit the investigation of a large range of questions that could not be fruitfully addressed with the previously existing data. In the IMDB, information on characteristics such as education is available at the time of entry to the country, and also migrants' earnings are traced through their income tax returns, which permits better estimates of lifetime income. It is also possible to distinguish the class of admission of immigrants. These features of the new data set allow a better treatment of selection issues and better measures of policy tools. The traditional literature on migration concentrated primarily on the movement from less developed countries to developed countries. More recently migration between developed countries has become an important issue. Estimating the underlying parameters of the decisions leading to this ever-increasing labour flow is therefore of major theoretical and policy interest. The U.S. and the U.K. are major immigrant source countries that provide skilled workers to Canada. Studying these two countries also has the advantage of more readily available data on non-migrants.

Estimation of the two-step framework provides important insights on the effects of the factors that determine the two steps. For example, for both source countries, more educated are more likely to be observed as migrants—a fact that can be observed from a simple probit. However, the two-step method shows that, in contrast to those from the U.K., higher educated individuals from the U.S. are less likely to apply, but because of the policy stage the resulting migrants are more educated. This may be related to returns to education in the various countries, which has to be investigated in future. The host country's selection is also found to have significant impact on characteristics of the immigrants. This result indicates that parameters determining the desire of

individuals to migrate cannot be properly identified without taking into account the impact of selection by the host country.

In the next section, the theoretical model of this study is outlined. Estimation issues are discussed along with a description of the econometric framework. Section 3 describes the relevant characteristics of the data utilized. Section 4 presents the empirical findings from the reduced form estimation. Section 5 concludes.

2. *THE MODEL*

2.1 Step (1)- The Decision to Apply (Application)

Consider the choice problem for an individual *i* located in the source country (*country 2*) and considering migration to the host country (*country 1*). Assume, as in the existing literature, that the decision can be represented as a utility maximizing problem over the lifetime and that monetary equivalents can be used. The individual then applies if the expected gain exceeds the application cost, C_{ai}. The expected gain is the difference between the expected income if the individual applies and that expected if the individual does not apply taking into account moving costs. If the individual applies, the application is successful with probability P_i^a. If the application is successful, the migrant receives an earnings stream in the host country with present value w_{1i} and incurs moving costs, C_{mi}. If the application is unsuccessful the migrant receives an earnings stream in the source country with present value w_{2i}. The expected income if the individual applies is thus:

$$P_i^a\,(\,w_{1i}-C_{mi}\,)+(1-\,P_i^a\,)w_{2i}$$

The expected income if the individual does not apply is simply, w_{2i}. The expected gain from applying is thus:

$$P_i^a\,(\,w_{1i}-C_{mi}\,)+(1-\,P_i^a\,)w_{2i}-\,w_{2i}$$

Potential migrants hence apply if:

$$P_i^a\,(\,w_{1i}-C_{mi}\,)+(1-\,P_i^a\,)w_{2i}-\,w_{2i}>C_{ai} \qquad (1)$$

$$(1)\;\Rightarrow\;P_i^a\,(w_{1i}-\,w_{2i}\,-\,C_{mi}\,)>C_{ai} \qquad (2)$$

If $C_{ai}=0$, the criterion reduces to:

$$(w_{1i}-\,w_{2i}\,-\,C_{mi}\,)>0 \qquad (3)$$

for non-zero P_i^a. The cost of application C_{ai}, is incurred at the time of the application. This is a variable cost depending on the number of dependents and does not include costs of moving, foregone earnings etc. which are included in C_{mi}. C_{ai} is generally small relative to the lifetime w's and is assumed to equal zero in the rest of the analysis.[5]

Thus, from (3), the probability of an individual making an application for migration depends positively on the permanent income level he expects in the host country, and negatively on his permanent income level in the source country and the moving costs. The moving costs include travel expenses, foregone earnings while moving and also psychological costs of movement. The returns and costs differ for each individual as they depend on individual characteristics such as age, schooling, gender, etc.

Following the previous literature, let[6]

$$C_{mi} = c_{mi}\, w_{2i}$$

where $c_{mi} \geq 0$ and using the approximation $\ln(1+c) \approx c$ (for small values of c), rewrite the equivalent criterion for applying as:

$$\ln w_{1i} - \ln w_{2i} - c_{mi} > 0$$

Let the present value of log lifetime earnings in the two countries be represented by the following linear functions:

$$\ln w_{1i} = X_{1i}\beta_1 + \varepsilon_{1i} \qquad (4.1)$$
$$\ln w_{2i} = X_{2i}\beta_2 + \varepsilon_{2i} \qquad (4.2)$$

And let

$$c_{mi} = X_{3i}\beta_3 + \varepsilon_{3i} \qquad (5)$$

where the X's are observable and the ε's are unobservable to the econometrician. The β coefficients represent the structural parameters of interest in the *application step*.

---

[5] The assumption of $C_{ai} = 0$ rules out any effect of review by host country on application decision. Relaxation of this independence assumption can only be done with more information on costs and changes in the model, and is left for future research.

[6] Robinson and Tomes (1980) give theoretical and empirical justification for this assumption. One justification is that the cost of migration is proportional to the source country permanent income due to the existence of source country specific investment and/or endowments. The linear specification $C_{mi} = c_{mi}\, w_{2i}$ follows from the convenience of functional form.

Next, define the following index:

$$I^*_{1i} = X_{1i}\beta_1 + \varepsilon_{1i} - X_{2i}\beta_2 - \varepsilon_{2i} - X_{3i}\beta_3 - \varepsilon_{3i} \equiv W_i\pi + \varepsilon_i \qquad (6)$$

so that the criterion for step (1) is $I^*_{1i} > 0$, or $\varepsilon_i > -W_i\pi$.

This can be estimated as a structural index if the separate terms $X_{1i}\beta_1$, $X_{2i}\beta_2$ and $X_{3i}\beta_3$ can be measured, and the β coefficients can be recovered under certain conditions (discussed later). Otherwise we have to work with the reduced form index $I^*_{1i} \equiv W_i\pi + \varepsilon_i$ and estimate π.[7,8]

2.2 *Step (2) - Host Country Chooses from the Pool of Applicants (Review)*

We assume that host countries have immigration policies that characterize the review step. This results in a mechanism for choosing immigrants from the pool of applicants. Assume that this mechanism can be represented by the index

$$I^*_{2i} = X_{4i}\beta_4 + \varepsilon_{4i} > 0 \qquad (7)$$

where X_{4i} are observable characteristics of the potential immigrant and any measurable policy parameters and ε_{4i} are unobservable to the econometrician.[9]

In the Canadian point system, if an individual gets a sufficient number of points (which is constant for all applicants in an admission category) then admission is granted to the individual. Points for relevant characteristics are determined and added together to find the total number of points an individual gets. For example, as of 1990 an individual gets 6 points if 19 years old, 8 points if 20 years old and 10 points if the age is between 21-44. One of the sources of uncertainty leading to ε_4 is the extra points generated as a result of the assessment of the applicant by the immigration officer.

The implicit assumption in the above specification of the selection index I^*_{2i} is that ε_4 is not correlated with X_4. If the migration officer tends to give higher points for "personal suitability"

---

[7] Earlier literature on international migration estimates the reduced form index $Y_i \equiv W_i\pi + \varepsilon_i$ is 1 if an individual migrates, 0 otherwise. Later in the text, this model is referred to as 'Reduced Form One-Step Model'.

[8] The decision making for applying for migration in this paper is at the individual level rather than being at the family level because the data on migrants doesn't include information that allows to identify any families.

[9] The specification of the selection index depends on the context of the study. In the Canadian context, the 'point system' can be approximated by such an index. In other cases where reasonable approximations are not possible, one may wish to identify a structure if there is enough information on the process. Where estimation of structural indices is not possible, a reduced form model can be utilized.

to the applicants who are close to the threshold value in the point system, this raises a potential non-zero correlation between ε_4 and X_4. However, since the story can be told in the opposite direction, it is not possible a priori to determine the sign of this potential correlation. Using the distribution of point scores, the correlation between ε_4 and individual components of X_4 as well as the total number points obtained from X_4 are investigated and no significant correlation is found.

2.3 Estimation of Parameters from the Two Steps

Given the above formulation, we can consider the individual and the host country as two decision makers $(j=1,2)$, each faced with a binary choice $I_{ji}=0,1$. Let

$$I_{ji}=1 \quad if \quad I_{ji}^{*}>0$$
$$=0 \ otherwise$$

Each individual's decision corresponds to a univariate probit model (if we assume normality for ε's), and the two decisions taken together correspond to a bivariate probit model. $I_{1i}=1$ if the individual i applies and $I_{2i}=1$ if the individual i is accepted.

Full observability corresponds to the case where for every individual whether that individual applied or not, and what decision is made by the host country for each individual applicant, can be observed. Given a random sample $(I_{1i}, I_{2i} \mid W_i, X_{4i})$, $(i=1,2,...,n)$, if the usual identification conditions hold (e.g. one of the vectors $(W_i \text{ or } X_{4i})$ excludes at least one exogenous variable appearing in the other vector) and subject to a normalization rule in each equation, π and β_4 are identified (Heckman, 1976, 1978; Amemiya, 1978). Under certain conditions the structural parameters of the application step can be estimated.

In the case considered here the choices I_{1i} and I_{2i} cannot be fully observed. For example, those who applied but were turned down is not known. The only information available is who actually migrated (that is who applied and was admitted) and who did not. This leads to the partial observability framework of Poirier (1980). Following Poirier, partial observability can be represented by the single binary random variable

$$Z_i = I_{1i} * I_{2i} \qquad i=1,2,...,n$$

$Z_i=1$ *iff* $I_{1i}=I_{2i}=1$, that is if the individual migrates and zero if not. Thus Z_i is the observed migration variable and the probability of migration is the joint probability:

$$\Pr(I_{1i}=1, I_{2i}=1)=\Pr(I_{2i}=1 \mid I_{1i}=1)\Pr(I_{1i}=1)=\Pr(Z_i=1)$$

Thus, the probability distribution of Z is:

$$\Pr(Z_i = 1) = \Pr(I_{1i} = 1 \text{ and } I_{2i} = 1) \equiv P_i^m$$
$$\Pr(Z_i = 0) = \Pr(I_{1i} = 0 \text{ or } I_{2i} = 0) = 1 - \Pr(I_{1i} = 1 \text{ and } I_{2i} = 1) = 1 - P_i^m$$

Given a random sample of observations on Z, the log likelihood for the sample can be specified given distributional assumptions on the ε's.

Assume that each individual in the source country draws a realization of the pair $(\varepsilon, \varepsilon_4)$ from the bivariate normal distribution $g(\varepsilon, \varepsilon_4, \rho)$, where ρ is the correlation between ε and ε_4.[10]

Given a random sample of observations $(Z_i | W_i, X_{4i})(i = 1,2,...,n)$, the log likelihood for the sample is:[11]

$$L(\pi, \beta_4, \rho) = \sum_{i=1}^{n} \{Z_i \ln G(W_i\pi, X_{4i}\beta_4; \rho) + (1 - Z_i) \ln[1 - G(W_i\pi, X_{4i}\beta_4; \rho)]\} \quad (8)$$

Letting $\theta = [\pi', \beta_4', \rho]$, the parameter vector 6 is to be estimated.

The likelihood function presented above in (8) presupposes an exogenous sampling process where a sequence of individuals are drawn at random and the joint outcomes (Z_i) of their choices over application and the host country's decision over granting admission are observed. In contrast, a choice-based sampling process is one where a sequence of chosen alternatives are drawn and the characteristics of the decision makers selecting those alternatives are observed (Manski and Lerman, 1977). In choice-based samples the usual ML estimates will impart some biases in estimated parameters. Manski and Lerman introduced an alternative estimator for these cases which provides consistent estimators. This method modifies the familiar ML estimator by weighting each observation's contribution to the log-likelihood function. If the outcome associated with observation n is the alternative i, that is migrant or non-migrant, then the weight imposed is $Q(i)/H(i)$, where $Q(i)$ is the fraction of the decision-making population with outcome i and $H(i)$ is the fraction for the choice-based sample. This method assumes that the analyst knows these two fractions.

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[10] Various assumptions regarding components of ε and ε_4 that are known to the individual but unknown to the econometrician can be made. For example, ε_4 may contain some personal characteristics unobserved to the econometrician, but known to the applicant that are relevant for the points system in addition to a subjective assessment component by the particular immigration officer that is unknown to the potential migrant and not revealed until the application process has occurred.

[11] Compared to the case with fully observed choices, the maximum likelihood estimates from (8) will be inefficient (Poirier, 1980). Also, issue of identification arises which is discussed later in the text.

Choice-based sampling is relevant in this study for the subpopulations of those who migrate and those who do not. The model is estimated with appropriate weights for choice-based sampling.[12]

The weight for a migrant $\left(a_i^m\right)$ is equal to the fraction of migrants in a certain group (such as males, aged 18 to 65) in source country population over the fraction of migrants in the sample (with previous restrictions) used for estimation. The weight for a non-migrant $\left(a_i^{nm}\right)$ is calculated similarly. The data provide the number of migrants from a source country over a period of time. Given the size of the source country population the weights can be calculated. The likelihood function taking into account choice-based sampling becomes:

$$L(\pi,\beta_4,\rho)=\sum_{i=1}^{n}\left\{Z_i a_i^m \ln G(W_i\pi, X_{4i}\beta_4;\rho)+(1-Z_i)a_i^{nm}\ln\left[1-G(W_i\pi, X_{4i}\beta_4;\rho)\right]\right\} \quad (8')$$

For identification of π and β_4 at least one variable in W is required not to be in X_4 or vice versa (Poirier, 1980). Estimation of π and β_4 is referred as "reduced form estimation" in the rest of the text.

Estimation of the parameters of the application step β_1, β_2 and β_3, along with β_4 is referred to as "structural estimation". A 3-step estimation procedure is suggested to obtain consistent estimates of β's. This method is an extension of the Heckman 2-stage method for sample selectivity. The earnings functions cannot be estimated for all individuals originally resident in the source country. For the migrants we observe $\ln w_{1i}$ and for the staying we observe $\ln w_{2i}$. Estimation of the earnings equations requires taking into account the double selection process. Equation (4.1) is estimated on the sample of migrants:

$$\begin{aligned} E\left[\ln w_{1i}\middle|Z_i=1\right] &= E\left[\ln w_{1i}\middle|I_{1i}^*>0 \quad and \quad I_{2i}^*>0\right] \\ &= X_{1i}\beta_1+E\left[\varepsilon_{1i}\middle|I_{1i}^*>0 \quad and \quad I_{2i}^*>0\right] \end{aligned} \quad (9)$$

Equation (4.2) , on the other hand, must be estimated on the sample of stayers:

$$E\left[\ln w_{2i}\middle|Z_i=0\right]=X_{2i}\beta_2+E\left[\varepsilon_{2i}\middle|Z_i=0\right] \quad (10)$$

where

$$\begin{aligned} Z_i=0 \quad if \quad & \left(I_{1i}^*<0 \quad and \quad I_{2i}^*>0\right) \quad or \\ & \left(I_{1i}^*>0 \quad and \quad I_{2i}^*<0\right) \quad or \\ & \left(I_{1i}^*<0 \quad and \quad I_{2i}^*<0\right) \end{aligned}$$

[12] Choice-based sampling also requires a correction for the standard errors. The correct standard errors for the choice-based sampling are calculated and reported later in the text with the parameter estimates.

To get consistent parameter estimates, Heckman's (1979) two stage procedure for a single selection rule has to be extended to two selection rules.[13]

The consequences of partial observability of the type discussed above are essentially two-fold. First, the maximum likelihood estimators obtained from (8′), compared to those obtained in the case of fully observed choices, are inefficient. The extent of efficiency loss cannot be addressed without reference to a particular data set. Second, identification problems arise that were discussed earlier.

2.4 Specification of the First and Second Selection Indices

The earnings functions for the two countries follow the semi-log form proposed by Mincer (1974):

$$\ln w_{ji} = X_{ji}\beta_j + \varepsilon_{ji}$$

where

$$X_{ji} = \{\text{schooling, degree, experience, language, training}\}_i$$

and higher order terms in experience. The language variable is in general important in a Canadian context. However, it is omitted in this study since the focus is on migration from the U.S. and the U.K. to Canada and migrants destined to the French speaking province of Quebec are excluded. Data reveal that migrants from the U.S. and the U.K. who have French language skills or those who are bilingual are almost always destined to Quebec. Remaining migrants from the U.S. and the U.K. destined to elsewhere in Canada are either native English speakers or speak English very well. Since there is no information on training in the data sets this variable is also omitted.

The variables ε_{1i} and ε_{2i} include general unobserved ability and unobserved country specific capital. It is assumed that, over the entire population of individuals initially located in the source country, ε_{1i} and ε_{2i} have zero means, variances σ_{11}, σ_{22} and covariance σ_{21}. No restrictions are imposed on the sign of σ_{21}. If unobserved skills that make an individual more productive in the source country also make an individual more productive in the host country, then $\sigma_{21} > 0$ (viewing unobserved skills as unidimensional); a theory of comparative advantage with multi-dimensional unobserved skills would permit $\sigma_{21} < 0$ (Robinson and Tomes, 1982). The

[13] Catsiapis and Robinson (1982) extend Heckman's procedure to cases with multiple selection rules where they assume full observability on I_{1i}^* and I_{2i}^*. Consistent parameter estimates are obtained by adding correction terms in an ordinary least squares (OLS) regression. Tunali (1986), discusses estimation under various assumptions of observability. There is a technical appendix that gives the details of the proposed 3-step estimation method for the case of partial observability that is available from the author upon request.

parameters β_1 and β_2 are not constrained to be equal, allowing rates of return for each characteristic to vary by country. For example, the location where the highest degree and training are completed can be important in the immigration context. Due to the lack of information on the quality of education acquired in different source countries, prospective employers at the source and host countries may value the same number of years of schooling differently.

The factor of proportionality c_{mi} is given by: $c_{mi} = X_{3i}\beta_3 + \varepsilon_{3i}$ where

$$X_{3i} = \{\text{family size, language, marital status, schooling}\}_i$$
$$\varepsilon_{3i} = \{\text{unobservable cost components}\}_i$$

ε_{3i} is assumed to have zero mean, variance σ_{33} and covariances σ_{23}, σ_{13}. It is argued that the presence of children, due to changing schools, etc., inhibits migration. Also, there is empirical evidence that the existence of a spouse increases costs of migration (Mincer, 1978). Schooling and language are hypothesized to reduce the information costs via better information and job prospects and lower the cost of moving. Again in the U.S.-Canada and the U.K.-Canada context the language variable is dropped.

Given the above specifications for X_{1i}, X_{2i}, X_{3i} and replacing experience with age in the reduced form estimation, W_i in (6) is given by:

$$W_i = \{\text{schooling, degree, age, family size, marital status}\}_i$$

The second selection index is represented as:

$$I_{2i}^{*} = X_{4i}\beta_4 + \varepsilon_{4i}$$

where

$$X_{4i} = \{\text{schooling, age, occupation, degree}\}_i$$

$$\varepsilon_{4i} = \{\text{unobservable components affecting admission}\}_i$$

The variables in X_{4i} correspond to the characteristics evaluated in the point system. More educated individuals get higher points. In general, applicants in white-collar occupations (Executive and Administrative, Professional Speciality, Teaching and Related Occupations) are awarded higher points compared to those in sales and blue collar occupations. Those who have arranged employment are more likely to be admitted as they are awarded extra points. It is assumed that the probability of having arranged employment depends on occupation, experience and degree. Younger applicants get higher points under the age factor, whereas older applicants who are relatively more experienced are awarded higher points under the experience factor. An

identification problem arises if experience, age and schooling are entered simultaneously since experience is calculated as (age (-)years of schooling (-) 6).

The 'personal suitability' factor which is determined by the immigration officer at an interview, factors that affect arranged employment that can not be captured by the characteristics in X_4, such as motivation, other factors such as medical condition preventing admission of an applicant, etc. contribute to the error term in the second selection index. The mean of the personal suitability and arranged employment points are captured in the intercept term. The remaining error component is assumed to have zero mean and constant variance over the population of the source country.

3. *THE DATA*

The reduced form model is estimated on pooled samples of migrants and non-migrants from the U.S. to Canada and the U.K. to Canada.

For estimation of the model, a sample in the source country at time t_1 would ideally need to be observed. Then the same sample would be observed at a later date t_2 to identify those who migrated and those who didn't, where the latter group is composed of people who either didn't apply to the host country for migration or applied but were rejected. Such a sample doesn't exist since source countries don't keep track of people leaving the country and host countries are only interested in who gets in rather than who is left out. This is a major difficulty for studies of international migration.

In this study we set t_1 to 1986 and t_2 to 1990. Using Canadian data we obtain a sample of individuals who applied from the source country starting in 1986 until the end of 1990 and who are accepted by the host country. This forms the migrant sample. The non-migrant samples are drawn from the 1990 U.S. Census and the 1991 U.K. Census.[14]

The migrant and non-migrant samples for a given source country are then pooled together which results in the choice based sample used for estimation of the model. The model is then estimated for the U.S. and the U.K. separately.

Immigrant samples used in the reduced form estimation are obtained by matching the Landings Records (LIDS) with the administrative file on migrants, the Immigration Data System Overseas (IDSO). For the estimation of the structural model, migrant records are obtained from the Longitudinal Immigration Database (IMDB) which matches migrant records in the LIDS with the earnings information in tax files. As data sets from different countries are used, several data availability/comparability issues arise that are discussed below.

[14] A concern here is that in the census data, e.g. in the 1990 U.S. Census, there may be individuals who applied, say, in 1989 and have not migrated by the census date because their application is not finalized. However, given the small number of people migrating from the source country to Canada relative to the size of the source country population, the number of such people in the non-migrant sample and the resulting contamination bias is negligible.

In LIDS each landing record contains demographic data (e.g. age, marital status, last permanent residence), program data (immigrant category, special program codes, principal applicant code) and personal characteristics (intended occupation, years of schooling, level of education, self-assessed knowledge of an official language). These data are recorded as of the date of issue of the landing visa and are available for all landings in Canada.

The IMDB combines information from landing records of immigrants with information recorded on the personal income tax returns (T1). Tax returns provide information on employment earnings, UI benefits, self-employment earnings and, since 1992, income assistance data. The database currently covers the period 1980 to 1995.[15]

IDSO provides the points awarded to principal applicants for each characteristic assessed under the point system. It also provides other administrative information such as the date the application was received, and the date of landing.

The distinguishing features of the IMDB, LIDS and IDSO are the inclusion of immigrant class/category, the special program codes, the principal applicant codes, the points and the longitudinal data on earnings. Immigrant class determines the selection criteria that apply to an immigrant. Principal applicant information indicates which immigrants are assessed and which are dependents. Special program codes indicate cases admitted under relaxed criteria. The longitudinal feature of IMDB provides several observations on earnings for an individual (e.g. up to ten observations for a migrant who landed in 1986). Hence, it permits better measures of lifetime earnings.

Most migration analyses have been carried out using census data. In census data it is not possible to identify the class of admission of migrants and it is not possible to distinguish the principal applicants from dependents. Without this information it is not possible to determine which individuals go through the point system. The admission criteria for different classes are substantially different from each other. For example, a migrant under family class is admitted on the basis of having a family member in the country and a sponsorship guarantee from that family member. The point system doesn't apply to this class. An independent migrant who is the principal applicant, on the other hand, has to pass the points test. Also, in the census data information about education, occupation etc. are as of the time of the census. Additional information provided in the IMDB, LIDS and IDSO allows for a detailed and more careful analysis of the immigration policy and labour force outcomes of immigrants.

[15] It should be noted that the characteristics of immigrants in the IMDB deviate from those of the landed immigrant population since the population as a whole—immigrants and non-immigrants alike—does not necessarily file a tax return. To be included in the IMDB a migrant has to file at least one tax return starting from the date of application. A study done by Carpentier and Pinsonneault (1994) finds that the IMDB is representative of the tax-filing population. Average characteristics in the IMDB resemble those generally found in the labour force.

The sample of migrants used in the reduced form estimation consists of male immigrants aged 18 to 65 whose application for migration was received between 1986 and 1990.[16,17]

United States migrants are those migrants whose country of last permanent residence is the U.S. United Kingdom migrants are those whose country of last permanent residence is England, Scotland, or Wales. Migrants whose last country of permanent residence is Northern Ireland are excluded from the sample since the U.K. Census individual file doesn't include individuals from Northern Ireland. The migrant samples are further restricted to skilled workers admitted under the independent class, who are principal applicants. The independent class consists of workers who are seeking admission on the basis of their labour market skills. Immigrants whose intended destination is Quebec are excluded. Immigrants who are admitted under special programs or those that pass the point test only with the immigration officer's discretion are also excluded. The reasons for these exclusion restrictions are discussed below. The resulting migrant sample from the U.S. consists of 2,500 records, the migrant sample from the U.K. consists of 5,718 records.

Over the period covered by the data set (1980-1995) there were several changes in the point system. Although the characteristics assessed remained mostly the same, the points associated with them were altered. Over the period 1980 to 1990, the periods 1980-1981, 1982-1985 and 1986-1990 can be identified as periods over which the selection criteria remained the same. We avoid the period 1982-1985 since during this period applicants were required to have arranged employment, otherwise rejection of the application was automatic. This requirement resulted in substantial reductions in the number of people being admitted. This restriction was lifted on January 1st, 1986. In this paper the period 1986-1990 is studied. Over this period the selection criteria did not change for the independent class.

Quebec has its own selection criteria, different from the rest of Canada. Applicants whose intended destination is Quebec are assessed by Quebec and have to satisfy the provincial requirements to be admitted. For this reason immigrants who are destined to Quebec are excluded.

Immigrants entering under special programs are assessed under relaxed criteria. Independent class applicants may be accepted even if they don't have enough points, by way of the immigration officer's discretionary power. This discretion, which is exercised very rarely, is different from the immigration officer's regular evaluation for personal suitability. An example of a special program would be accepting immigrants from a country that had a natural disaster. For the admission of these migrants some or all of the characteristics in X_4 may be irrelevant, and these migrants are excluded from the sample as well.

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[16] An analysis of migration by females is beyond the scope of this study. It would require incorporating a third selection problem, since a sizeable fraction of women are non-labour force participants.

[17] There is a concern that older people may have weak labour force attachment, and thus they will not be representative of the individuals who are migrating for economic reasons. In order to test the robustness of results presented later in the paper to the age restriction 18 to 65, the models are estimated by restricting the sample to males between ages 20 and 55. All the qualitative results (not presented) remain the same.

From the 1/100 U.S. Census a 1/60 random sample is drawn that is restricted to males aged 18 to 65. Similarly, from the 2/100 U.K. Census a 1/16 random sample is drawn that is restricted to males aged 18 to 65. These samples refer to non-migrants, that is individuals who didn't apply or who applied but were rejected for immigration to Canada. The resulting non-migrant sample from the U.S. consists of 10305 records and the non-migrant sample from the U.K. consists of 18347 records. Pooled migrant-nonmigrant samples consist of 12,805 and 24,065 records for the U.S. and the U.K., respectively.

Tables 1 and 2 give the definitions of variables in the pooled samples for the U.S. and the U.K. as source countries respectively. Tables 3 and 4 present the descriptive statistics for the migrants and non-migrants for the two source countries.

Tables 3 and 4 reveal that migrants are composed of younger, more educated individuals concentrated in white-collar occupations that are more likely to be married relative to non-migrants. The major difference between the U.S. and the U.K. migrants is that, those from the U.K. are much younger.

4. *ESTIMATION OF THE REDUCED FORM MODEL*

4.1 Reduced Form One-Step Model

First a reduced form model ignoring step (2) is estimated. This model is referred to as the 'Reduced form one-step model' and is given by:

$$Y_i = W_i\pi + \varepsilon_i$$

where Y_i is equal to 1 if an individual is observed as a migrant; 0 otherwise. W_i is identical to the vector W_i in the first selection index in equation (6) presented in section 2.1. As indicated earlier this is the model employed in the previous literature. It provides a benchmark for comparison of the results obtained from the two step model suggested in this study with the results available in the literature.

Tables 5 and 7 present the probit estimates of the reduced form one-step model for the pooled sample of migrants-nonmigrants from the U.S., and from the U.K., respectively. The first columns show the parameter estimates while the third columns present the marginal effects,[18] both corrected for choice based sampling. Standard errors are given in parentheses.

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[18] Marginal effects are equal to $\frac{\partial E[Y]}{\partial \beta_i}\beta_i$. Partial derivatives with respect to the vector of characteristics are computed at the means of the characteristics in the sample. Indicator variables are being set at their sample proportions. Because of the existence of indicator variables, marginal effects are approximations of the impact of the binary co-variates on the probability of observing an individual as a migrant.

Also, note that the marginal effects in Tables 5, 7, 9 and 12 are to be interpreted in the following context: Given the incidence of migration of males from the U.S. to Canada over the 1986-1990 period, the probability of observing a male in the U.S. as an immigrant in Canada by 1990 is 4.15e-5. Similar figure for the U.K. is 3.91e-4.

The coefficient of *yrssch* in Table 5, and the coefficients on *univ_np* and *postgra* in Table 7 are positive, indicating that individuals with higher education are more likely to migrate.[19]

If the host country is assumed to play no role in the observed selectivity of migrants, then these results would be interpreted as more educated individuals have more incentives to migrate. This suggests a positive selection among the individuals from the source country populations that implies the returns to human capital characteristics are higher in the host country than the source countries. However, if host country affects the observed selectivity of migrants, it is not possible to distinguish whether positive selection in terms of education is a result of higher returns to education in host country, or a result of host country's selection of highly educated individuals from the pool of applicants.

Results also suggest that increasing age increases the probability of migration until age 35 (31) for the U.S. (U.K.) case, beyond which it contributes negatively to the probability of migration. Married individuals are more likely to become migrants and having dependents decreases the probability of being a migrant. Marriage may be expected to inhibit migration as more tied stayers are expected to be less mobile relative to single, widowed or separated people. However, Mincer (1978) points out that single individuals may also be tied stayers.

Tables 6 and 8 present the model fit for the reduced form one-step model for the U.S. and U.K. cases.[20] The model for the U.S. (U.K.) has a correct prediction rate of 81.1% (59.8%) for non-migrants and 81.5% (78.8%) for migrants. Overall the correct prediction rate in the unweighted pooled sample is 81.2% (64.3%). The model fit is worse for the U.K. case compared to the U.S. case, possibly due to unavailability of co-variates, such as years of schooling.

4.2 Estimation of the Reduced Form Model for Two-Step Migration Process

The estimates from the model presented in the previous section have been interpreted in the literature as if the host country plays no role on the observed migration outcomes. If parameters

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[19] To test the robustness of the results regarding education variables the model for the U.S. case was estimated with a different specification. A new variable *univ* was created, equal to 1 if individual has a university degree or a post graduate degree; 0 otherwise. The *univ* variable replaced the *yrssch* variable to capture the effect of education. The estimated coefficient of the variable *univ* has a positive sign, suggesting that the more educated are more likely to migrate — ignoring the selection by the host country.

A similar exercise was done for the U.K. case that provides better comparability between the results for the U.S. and the U.K. cases. The model for the U.K. was re-estimated with a different specification where a new variable *seced* was created, equal to 1 if the individual has a university degree or a postgraduate degree, replacing the previous education variables *univ_np* and *postgra*; 0 otherwise. This variable is comparable to the education variable *univ* in the last specification for the U.S. case where *yrssch* variable is dropped. The estimated coefficient of *seced* is positive, suggesting that the more educated are more likely to migrate.

[20] In order to estimate whether an individual is a migrant or not, the probability of observing an individual as a migrant is calculated using the model specification and the parameter estimates, given the characteristics of the individual. If this probability is greater than the proportion of migrants in the *weighted* sample, then the individual is predicted to be a migrant; otherwise a non-migrant. These predicted probabilities are cross-tabulated with actual (observed) outcomes in the sample to obtain the model fit.

of interest are the factors that determine individuals' decision to migrate, then estimation of the model in section 4.1 cannot provide any answers. Also, one-step model precludes analysis of the effects of immigration policy on migration.

In this section, the 'reduced form two-step model' is estimated assuming that the distribution of ε_4 is the same among migrant and non-immigrant population.[21,22]

The coefficients of the first selection index in the two-step reduced form model indicate the total effect of the exogenous variables on the probability of applying, acting through the wage differential for migrating versus staying and through the cost of moving. The coefficients of the second selection index give the effect of exogenous variables on the probability of acceptance.

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[21] As noted earlier, subjective assessment by the immigration officer of "personal suitability" of a potential migrant contributes to ε_4. IDSO provides points for personal suitability of those interviewed. Normality of points from personal suitability is tested using the Bowman and Shenton chi-squared statistic. The null hypothesis of normality can not be rejected at the 1% level. Points from personal suitability have a mean of 7.0 and a standard deviation of 1.2. The number of points from personal suitability (*pts_pers*) is assumed to be equal to: $pts_pers = \overline{pts_pers} + \varepsilon'$ where $\overline{pts_pers} = 7$ and ε' is distributed as normal with mean zero and constant variance for the migrant and non-migrant populations. The random error term ε' and factors that affect arranged employment which are not captured by the model jointly determine ε_4, which is assumed to have a normal distribution with mean zero and constant variance.

We also investigate the implicit exogeneity assumption in the model that is the exogeneity of pts_pers (or ε'). We calculate the correlation coefficients between pts_pers and points from other characteristics (points from education, specific vocational preparation, experience, age, occupational demand, knowledge of English, knowledge of French, arranged employment), as well as the correlation between pts_pers and total of points from all other characteristics (pt_all). Below table presents the results:

	pt_edu	pt_svp	pt_exp	pt_age	pt_occd
pts_pers	-.27	-.27	-.02	-.03	-.04
	pt_eng	pt_fr	pt_arre	pt_all	-
pts_pers	.02	.05	-.06	-.2	-

The null hypothesis of zero correlation can not be rejected at 5% level for all pairs of correlation coefficients in above table. We also test the dependence between pts_pers and other points listed in the above table. We calculate Hoeffding's D statistics for all pairs and we can not reject the null hypothesis of independence.

[22] The results obtained in this and the previous subsections are subject to the distributional assumptions made regarding the error terms. One of the referees suggested using Census data for estimation that will allow a larger proportion of immigrants in order to test sensitivity of results to the distributional assumptions. However, as indicated before, Census data doesn't have information on the category of immigrants, e.g. independent migrants, refugees etc., therefore it is not possible to know who actually goes through the points test. The model could be estimated with a larger number of immigrants by studying a longer period of immigration (e.g. period of 1980-1990, rather than the 1986-1990 period studied in this paper). There is, however, a trade-off between more observations and problems associated with having different immigration policies effective over a longer period. Moreover, the increase in fraction of immigrants over a longer period will be very small given the large source country populations.

Table 9 presents the results of the estimation of the two-step reduced form model for the U.S. as the source country. The striking result from the first selection index, referring to the application decision, is that individuals with higher years of schooling are less likely to apply for migration.[23]

This is in contrast with the positive coefficient obtained in the one-step model suggesting the opposite. The first implication of this result is that more educated individuals have better returns in their source country relative to the host country. This stresses that the opportunities available to individuals in host countries may be very important in attracting high quality migrants. Second, the average applicant in the applicant pool is less educated relative to the individuals in the source country. However, the educational attainment of the migrants who are selected from this pool depends also on the host country's selection process.

Estimates of the parameters in the first selection index also indicate that increase in the number of dependents increases the cost of migration, hence, reduces the probability of applying. Married individuals are more likely to wish to migrate. Increasing age initially increases the probability of applying for migration, later decreases this probability.

The second selection index refers to the review of applications by the host country. Having more schooling increases the probability of admission. The more educated individuals get higher points in the point system. The negative coefficient of *yrssch* in the first selection index and the positive coefficient in the second selection index indicate that increasing education makes individuals less likely to apply, but the point system selects the more educated amongst those who apply. The negative coefficient on *age* indicates that older individuals are less likely to be granted admission. This is consistent with structure of the point system. Individuals in executive, administrative, managerial or professional occupations are more likely to be admitted relative to those in the omitted category of blue-collar occupations. The white-collar occupations receive higher points under occupational demand and specific vocational preparation (SVP) factor in the point system. Individuals in the above white-collar occupations are awarded a high number of points under the occupational demand category and they are also more likely to have arranged employment, which increases their probability of acceptance. The estimated correlation coefficient ρ indicates that unobserved components affecting application are negatively correlated with the discretionary portion of the application review process. For example, during the application review process, through an interview, the applicants who are more motivated may be getting higher points under the 'personal suitability' category, increasing their chances of admission. A negative correlation coefficient indicates that it is those people who are more motivated that are less likely to apply. This is consistent with the finding that more educated

[23] To test the robustness of the results regarding education variables the model for the U.S. case was estimated with different specifications of education. In one of the specifications, a new variable *univ* was created, equal to 1 if individual has a university degree or a post graduate degree; 0 otherwise. The *univ* variable replaced the *yrssch* variable in both indices to capture the effect of education. The estimated coefficient of the variable *univ* has a negative sign in the first selection index and a positive sign in the second selection index, leading to the conclusion that higher educated individuals are less likely to apply. In another specification the model included separate intercepts and separate slopes for 1-12 years of schooling, 13-16 years of schooling, and more than 16 years of schooling. All the qualitative results remain the same in this specification.

individuals are less likely to apply and the fact that more educated are also likely to be individuals with higher motivation.

Model fit is presented in Table 10. The model has a correct prediction rate of 83.9% for non-migrants and 84.4% for migrants. Overall the correct prediction rate in the unweighted pooled sample is 83.9%. Table 11 presents the descriptive statistics for the variables using the predicted outcomes from the two-step model. Comparison of the Table 3 and 11 shows that the estimated model is successful in replicating the observed selectivity of migration in terms of individual characteristics, such as age, years of schooling, occupational distribution, etc.

Table 12 presents the results of the estimation of the two-step reduced form model for the U.K. as the source country. Similar to the results presented for the U.S. in this section, the first selection index, which determines the decision to apply, indicates that married individuals are more likely to apply and having dependents reduces the probability of observing an individual as an applicant. Individuals who are widowed, divorced or separated (*wdivsep*) are less likely to apply relative to single individuals which may be due to the costs of leaving the children behind when migrating. Increasing age initially increases the probability of application, later reduces this probability.[24]

The most surprising results compared to the results from the U.S. case are those related to education. Individuals from the U.K. with higher education, as measured by the co-variates *univ* and *postgra*, are more likely to apply[25], whereas individuals with more schooling were found to be less likely to apply in the U.S. This may be the result of different earnings opportunities for the highly educated individuals in these source countries relative to the host country. The different conclusions for the U.S. and the U.K. have important implications for the screening process. Relative to the source country populations, the applicant pool from the U.K. will be more educated; whereas the one from the U.S. is less educated. These differences between the

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[24] Increasing age increases the probability of application up to age 54. This cut-off point is much higher compared to the estimated 31 years in the one-step model. As discussed earlier, descriptive statistics from Table 4 indicate that among the migrants from the U.K. the proportion of those who have a university or postgraduate degree is much higher relative to nonmigrants, and also almost 50% of the migrants are concentrated in white-collar occupations. The high cut-off point for age may be explained by these highly educated individuals in white-collar occupations (who are very mobile) being attracted to well paying jobs as their experience increases.

Comparing the mean age and its standard deviation among the actual migrants and those predicted by the model from Tables 4 and 14 respectively, reveals that mean age among the actual migrants is 33.35 and the standard deviation is 7.18 compared to a mean age of 32.16 and a standard deviation of 5.17 among the migrants predicted by the model. Minimum and maximum age (not reported in the tables) among the actual migrants are 18 and 65, compared to 19 and 55 years among the migrants predicted by the model. These observations confirm that the high cut-off point is not likely to be a result of a misprediction of the ages of migrants by the model.

[25] To test the robustness of the results regarding education variables, and also to provide better comparability between the results for the U.S. and the U.K. cases the model was reestimated with a different specification. A new variable *seced* was created, equal to 1 if an individual has a university degree or a postgraduate degree, replacing the previous education variables *univ_np* and *postgra* in both selection indices. This variable is comparable to the education variable in the specification for the U.S. case where only variable *univ* is included to capture the impact of education. The estimated coefficients of *seced* are positive in both indices, indicating that the more educated are more likely to apply, and also they are more likely to be accepted by the host country.

applicant pool and the source country population are more pronounced if earnings opportunities are substantially different in the source country relative to the host country. Therefore, attracting the targeted number of high quality migrants by the host country with a screening process that is the same across all countries may be hard to achieve. It is, of course, true that using a different set of rules for different source countries does raise some equity concerns.

In the second selection index which refers to the review step, parameter estimates for the U.K. indicate that older individuals are less likely to be accepted, while those with high levels of education and with white collar occupations are more likely to be granted admission.[26]

The positive and significant correlation coefficient ρ indicates that unobserved components affecting application are positively correlated with the discretionary portion of the application review process. This may suggest that, if individuals who are more motivated are more likely to apply, then they are more likely to be accepted at the review step. There is no a priori reason to believe that ρ will have the same sign across different source countries as it depends, among other things, on the subjective evaluation of the immigration officers and unobserved components affecting the probability of having arranged employment, both of which may vary across countries.

Model fit is presented in Table 13. The model has a correct prediction rate of 61.6% for non-migrants and 77.2% for migrants. Overall the correct prediction rate in the unweighted pooled sample is 65.3%. The lower predictive power for the U.K. relative to the U.S. is also reflected by a comparison of Table 14 which presents the descriptive statistics for the variables using the *predicted* outcomes from the two-step model with the observed outcomes in the data presented in Table 4.

4.3 Simulations Using Reduced Form Two-Step Model

Most of the change in the skill distribution of migrants since the 1960's both in the U.S. and Canada has been attributed in the past to the changing source country mix of migrants (Borjas, 1993). The fall in the educational attainment of migrants was attributed to the new source countries with less educated populations replacing the traditional source countries. Given the estimates of π and β_4, we can analyze the effects of different educational levels in the source countries on immigration flows under a fixed immigration policy.

Assume that there are two hypothetical source countries. In the first source country each individual is the exact replica of the individuals in the U.S. population except for having 1.5 years less schooling than their counterparts. In the second, each individual has 1.5 years more schooling. How does the educational attainment of migrants from the U.S. compare to the educational attainment of migrants from the hypothetical 'Lower Educational Attainment Country' (LEAC) and the 'Higher Educational Attainment Country' (HEAC)? Table 15 presents

[26] Given the increasing incentives to migrate up to 54 years as suggested by the first selection index and the mean age 33.35 among the migrants, the review step is likely to be rejecting many applicants at older ages through the point system.

the estimated years of schooling for migrants and non-migrants from the LEAC and the HEAC, and the observed values of those for the U.S.

There are two important results of the model from this exercise. First, the migrants from the LEAC are more educated than the U.S. and HEAC migrants in terms of years of schooling. The country with the lowest educational attainment generates the highest skilled migrants (in terms of education). Secondly, the number of migrants from the higher educational attainment countries is larger relative to the source country population.[27]

Therefore shifting country of origin of migrants from the traditional highly educated source countries to the source countries with lower educational attainment does not necessarily result in a fall in average educational attainment of migrants within the skilled worker category. The deterioration in the educational attainment cited in the literature may be due to the migrants in other categories, such as family class or refugee class, or may be a result of changing incentives to migrate.

5. *CONCLUSIONS*

This study specifies migration as a two step process. In the first step the individuals decide to apply for migration and in the second step host country selects migrants from the applicant pool. The theoretical focus of the earlier literature was just on the desire to migrate, and the empirical literature focused on who actually migrates, which is the product of these two factors. Parameters in the two-step model relate directly to policy instruments such as the points awarded for various characteristics. Given the parameter estimates of the model, the general analysis of immigration policy, and an analysis of specific Canadian policies, as well as the factors determining the decision of individuals to apply can be studied in a way that hitherto has not been possible.

The model is estimated using the U.K. and the U.S. Census data for non-migrants and a new data set of migrants to Canada, the Longitudinal Immigration Database (IMDB). The richness of the IMDB database, which follows immigrants to Canada over a long period and contains information on both their application and subsequent earnings, permits the investigation of a large range of questions that could not be fruitfully addressed before. Estimation of the two-step framework provides important insights on the effects of the factors that determine the two steps. For example, for both source countries, more educated are more likely to be observed as migrants—a fact that can be observed from a simple probit. However, the two-step method shows that, in contrast to those from the U.K., higher educated individuals from the U.S. are less likely to apply, but because of the policy stage the resulting migrants are more educated. This may be related to returns to education in the various countries, which has to be investigated in future. The host country's selection is also found to have significant impact on characteristics of the immigrants. This result indicates that parameters determining the desire of individuals to migrate cannot be properly identified without taking into account the impact of selection by the host country.

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[27] Note that since the parameter estimates from the U.S. case are being used, it is assumed that in LEAC and HEAC returns to schooling relative to the host country are similar to the U.S./Canada case.

For the application step the conventional structure involving the wage variables is outlined. Using the selectivity-corrected returns to various characteristics for migrants and non-migrants, the 'opportunity wages' of individuals, that is, the wages of migrants had they stayed and non-migrants had they migrated can be estimated. Within this framework, issues such as the effect of changes in the policy structure on migration outcomes, the effects of policies that indirectly affect migration via effects on net of tax wage rates can be addressed. There are discussions in the policy circles about the impact of taxes on the desire of individuals to migrate between Canada and the U.S. There are also theoretical studies in the optimal taxation literature that try to find the optimal taxes when there is international personal mobility (e.g. Wilson, 1992). The extent of migration that is induced by taxes via their effect on permanent incomes can be simulated within this framework. Besides the optimal taxation literature, these results may be of interest for studies that try to assess theoretically the impact of international factor movements on the personal distribution of income (e.g. Davies and Wooton, 1992).

Table 1
Definitions of Variables, Source Country: United States

Variable Type	Definition	Mnemonic
Migration	1: if application for migration received between 1986-1990 and accepted; 0 otherwise	migr
Wage	Natural logarithm of annual wage (see notes below)	l_wage
Schooling	(Years of schooling completed)/10	yrssch
Age	(Age)/10 and its square	age
		agesq
Experience	Labour market experience= (Age-Yrssch-6)/10; and its square	exper
		expersq
Marital Status	Married: 1: if married or common law; 0: otherwise (Reference group is single-never married, widow or separated)	married
Dependents	Dep1: 1:if number of dependent is equal to 1; 0: otherwise	dep1
	Dep2: 1:if number of dependents is equal to 2; 0: otherwise	dep2
	Dep3: 1:if number of dependents is equal to 3; 0: otherwise	dep3
	Depg3: 1:if number of dependents is greater than 3; 0: otherwise (Reference group is those with no dependents – see notes below for details)	depg3
Occupation	Exec: 1: if executive, administrative or managerial occup.; 0: otherwise	exec
	Prof: 1: if professional speciality occup.; 0: otherwise	prof
	Techn: 1: if technician and related occup.; 0: otherwise	techn
	Sales: 1: if sale occup.; 0: otherwise	sales
	Service: 1: if service occup.; 0: otherwise	service
	Farm: 1: if farming, forestry, and fishing occup.; 0: otherwise (Reference group is other blue-collar occupations)	farm

Notes for Table 1:
Wages refer to the following:

- Nonmigrants: Income from wages and salary in 1989 + income from self-employment as reported in the 1990 U.S. Census.
- Migrants: income from wages + income from self-employment obtained from T1 forms.
- Number of dependents is calculated as follows:
  - Migrants: number of potential visas to be issued to a principal applicant and the dependents excluding the principal applicant and the spouse. Visas are issued to spouse, children who are never married under the age 18, or children over 18 who are dependent on their parents due to for example a long-term illness.
  - Non-migrants: number of persons in the family excluding the parents.

Table 2

Definitions of Variables, Source Country: United Kingdom

Variable Type	Definition	Mnemonic
Migration	1: if application for migration received between 1986-1989 and accepted;	migr
	0: otherwise	
Degree	Univ: 1: if individual has a university degree but no postgraduate degrees;	univ_np
	0: otherwise	
	Postgra: 1: if individual has postgraduate degrees; 0: otherwise	postgra
	(Reference group is individuals with education below a university degree)	
Age	(Age)/10 and its square	age
		agesq
Marital Status	Married: 1: if married or common law; 0:otherwise	married
	Wdivsep: 1: if widowed or separated; 0:otherwise	wdivsep
	(Reference group is single-never married)	
Dependents	Dep: 1: if there are any dependent children; 0: otherwise	dep
	(further details follow the table)	
Occupation	Occwht: 1: if occupation is in group 1; 0: otherwise	occwht
	(see below for definition of group 1 occupations)	

Notes for Table 2:

- Number of dependents is calculated as follows:
- Migrants: See notes to Table 1.
- Non-migrants: Number of resident dependent children in household. Resident dependent children are persons aged 0-15 in a household and persons aged 16-18 never married in full time education and economically inactive.
- Occupational Group 1 includes following white-collar occupations: Managerial, Administrative and Related Occupations, Occupations in Social Science and Related Fields, Occupations in Religion, Teaching and Related Occupations, Occupations in Medicine and Health.

Table 3
Descriptive Statistics, Source Country: United States

	Migrants		Non-Migrants	
	Mean	Std. Dev.	Mean	Std. Dev.
age	3.79	0.81	4.02	1.25
yrssch	1.77	0.33	1.30	0.29
dep1	0.15	0.36	0.21	0.40
dep2	0.20	0.40	0.23	0.42
dep3	0.08	0.27	0.10	0.30
depg3	0.01	0.10	0.08	0.27
married	0.74	0.43	0.66	0.47
exec	0.35	0.47	0.18	0.38
prof	0.54	0.49	0.10	0.30
farm	0.004	0.06	0.040	0.19
sales	0.014	0.11	0.151	0.35
service	0.010	0.09	0.078	0.26
techn	0.018	0.13	0.034	0.18
N	2,500		10,305	

Note: For dummy variables, mean values reported correspond to the proportion of individuals in the sample with that characteristic.

Table 4
Descriptive Statistics, Source Country: United Kingdom

	Migrants		Non-Migrants	
	Mean	Std. Dev.	Mean	Std. Dev.
age	3.335	0.718	3.865	1.266
univ_np	0.182	0.386	0.158	0.364
postgra	0.115	0.319	0.018	0.136
dep	0.527	0.499	0.392	0.488
married	0.726	0.445	0.630	0.482
wdivsep	0.041	0.199	0.069	0.254
occwht	0.493	0.500	0.328	0.469
N	5,718		18,347	

Note: For dummy variables, mean values reported correspond to the proportion of individuals in the sample with that characteristic.

Table 5
Reduced Form One-Step Model Source Country: United States

	Coefficient		Marginal Effect	
constant	-7.161	(0.14)		
age	0.726	(0.07)	2.0e-5	(1.9e-6)
agesq	-0.104	(0.01)	-2.9e-6	(2.5e-7)
yrssch	1.389	(0.04)	3.8e-5	(2.1e-6)
dep1	-0.222	(0.02)	-4.7e-6	(4.9e-7)
dep2	-0.248	(0.02)	-5.3e-6	(4.9e-7)
dep3	-0.232	(0.03)	-4.4e-6	(4.8e-7)
depg3	-0.609	(0.06)	-7.0e-6	(5.3e-7)
married	0.119	(0.02)	3.0e-6	(5.3e-7)
N		12805		

Note: Estimation results from a univariate probit model. Standard errors are given in parentheses

Table 6
Frequencies of Actual and Predicted Outcomes
One-Step Model, Source Country: United States

		Predicted		
		0	**1**	**Total**
Actual	**0**	8364 0.811 0.947	1941 0.188 0.488	10305 1 0.804
	1	464 0.185 0.0053	2036 0.815 0.512	2500 1 0.196
	Total	8828 0.689 1	3977 0.311 1	12805 1 1

Note (Table 6): Bold case **0** indicates a non-migrant, **1** indicates a migrant. The elements in the table are the frequencies, the row and column percentages.

Table 7
Reduced Form One-Step Model Source Country: United Kingdom

	Coefficient		Marginal Effect	
constant	-5.007	(0.08)		
age	1.071	(0.05)	7.4e-4	(2.4e-5)
agesq	-0.172	(0.01)	-1.2e-4	(3.1e-6)
dep	-0.028	(0.01)	-1.9e-5	(7.3e-6)
married	0.216	(0.01)	1.4e-4	(9.9e-6)
widvsep	0.053	(0.02)	4.0e-5	(2.0e-5)
univ_np	0.049	(0.01)	3.6e-5	(9.7e-6)
postgra	0.538	(0.02)	1.0e-3	(1.0e-4)
N			24,065	

Note: Estimation results from a univariate probit model. Standard errors are given in parentheses

Table 8
Frequencies of Actual and Predicted Outcomes
One-Step Model, Source Country: United Kingdom

		Predicted		
		0	**1**	**Total**
Actual	**0**	10978 0.598 0.900	7369 0.402 0.620	18347 1 0.762
	1	1216 0.212 0.100	4502 0.788 0.380	5718 1 0.236
	Total	12194 0.506 1	11871 0.494 1	24065 1 1

Note (Table 8): Bold case **0** indicates a non-migrant, **1** indicates a migrant. The elements in the table are the frequencies, the row and column percentages.

Table 9
Reduced Form Two-Step Model Source Country: United States

		Coefficient		Marginal Effect	
	constant	-3.28	(0.36)		
	age	3.16	(0.21)	4.8e-5	(4.5e-6)
	agesq	-0.37	(0.02)	-5.7e-6	(5.4e-7)
First Selection Index	yrssch	-0.41	(0.15)	-6.4e-6	(9.3e-7)
(Application Decision)	dep1	-1.03	(0.08)	-1.5e-5	(1.4e-6)
	dep2	-1.11	(0.08)	-1.7e-5	(1.5e-6)
	dep3	-1.07	(0.09)	-1.6e-5	(1.5e-6)
	depg3	-2.04	(0.13)	-3.1e-5	(3.0e-6)
	married	0.58	(0.05)	9.0e-6	(8.7e-7)
		Coefficient		Marginal Effect	
	constant	-4.94	(0.07)		
	age	-0.15	(0.01)	-8.6e-8	(8.5e-8)
	yrssch	1.06	(0.03)	5.9e-5	(4.0e-7)
	exec	0.36	(0.01)	2.0e-5	(1.3e-7)
Second Selection Index	prof	0.34	(0.01)	1.8e-5	(1.4e-7)
(Application Review)	techn	-0.004	(0.02)	-2.4e-7	(1.9e-7)
	sales	-0.26	(0.02)	-1.4e-5	(2.1e-7)
	service	-0.07	(0.03)	-4.3e-6	(2.3e-7)
	farm	-0.06	(0.04)	-3.7e-6	(3.5e-7)
	Rho($\varepsilon, \varepsilon_4$)	-0.56	(0.01)		
	N	12,805			

Note: Estimation results from a bivariate probit model with partial observability: Standard errors are given in parentheses.

Table 10
Frequencies of Actual and Predicted Outcomes
Two-Step Model, Source Country: United States

		Predicted		
		0	**1**	**Total**
Actual	**0**	8645 0.838 0.956	1660 0.162 0.440	10305 1 0.804
	1	391 0.156 0.044	2109 0.844 0.560	2500 1 0.196
	Total	9036 0.705 1	3769 0.295 1	12085 1 1

Note (Table 10): Bold case **0** indicates a non-migrant, **1** indicates a migrant. The elements in the table are the frequencies, the row and column percentages.

Table 11
Descriptive Statistics for *Predicted* Outcomes
Two-Step Model, Source Country: United States

	Migrants		Non-Migrants	
	Mean	Std. Dev.	Mean	Std. Dev.
age	3.83	0.81	4.03	1.30
yrssch	1.77	0.26	1.24	0.25
dep1	0.16	0.37	0.21	0.41
dep2	0.21	0.41	0.23	0.42
dep3	0.09	0.28	0.10	0.30
depg3	0.01	0.10	0.09	0.28
married	0.75	0.42	0.64	0.47
exec	0.40	0.49	0.13	0.34
prof	0.54	0.49	0.04	0.20
farm	0.002	0.04	0.04	0.21
sales	0.003	0.05	0.17	0.38
service	0.004	0.06	0.09	0.28
techn	0.015	0.12	0.03	0.19
N	3,788		9,017	

Note: For dummy variables, mean values reported correspond to the proportion of individuals in the sample with that characteristic.

Table 12
Reduced Form Two-Step Model Source Country: United Kingdom

		Coefficient		Marginal Effect	
First Selection Index (Application Decision)	constant	-7.81	(0.107)		
	age	2.94	(0.087)	5.8e-4	(4.9e-5)
	agesq	-0.27	(0.017)	-5.3e-5	(4.3e-6)
	dep	-0.54	(0.009)	-1.0e-4	(1.6e-5)
	married	0.85	(0.011)	1.7e-4	(2.6e-5)
	wdivsep	-0.07	(0.016)	-1.4e-5	(9.1e-6)
	univ_np	0.16	(0.011)	3.2e-5	(7.2e-6)
	postgra	0.86	(0.031)	1.7e-4	(3.0e-5)
		Coefficient		Marginal Effect	
Second Selection Index (Application Review)	constant	-1.89	(0.023)		
	age	-0.37	(0.004)	-6.1e-4	(8.6e-7)
	univ_np	-0.08	(0.003)	-1.3e-4	(1.5e-6)
	postgra	0.36	(0.004)	5.9e-4	(3.1e-6)
	occwht	0.15	(0.002)	2.5e-4	(9.4e-7)
	Rho($\varepsilon, \varepsilon_4$)	0.37	(0.043)		
	N	24,065			

Note: Estimation results from a bivariate probit model with partial observability: Standard errors are given in parentheses.

Table 13
Frequencies of Actual and Predicted Outcomes
Two-Step Model, Source Country: United Kingdom

		Predicted		
		0	**1**	**Total**
Actual	**0**	11318	7029	18347
		0.616	0.384	1
		0.896	0.614	0.762
	1	1305	4413	5718
		0.228	0.772	1
		0.104	0.386	0.238
	Total	12623	11442	24065
		0.524	0.476	1
		1	1	1

Note (Table 13): Bold case **0** indicates a non-migrant, **1** indicates a migrant. The elements in the table are the frequencies, the row and column percentages.

Table 14
Descriptive Statistics for *Predicted* Outcomes
Two-Step Model, Source Country: United Kingdom

	Migrants		Non-Migrants	
	Mean	Std. Dev.	Mean	Std. Dev.
age	3.216	0.517	4.213	1.394
univ_np	0.198	0.398	0.132	0.339
postgra	0.084	0.278	0.003	0.054
dep	0.509	0.499	0.348	0.476
married	0.721	0.448	0.592	0.491
wdivsep	0.041	0.199	0.082	0.274
occwht	0.487	0.499	0.259	0.438
N	11,442		12,623	

Note: For dummy variables, mean values reported correspond to the proportion of individuals in the sample with that characteristic.

Table 15
Educational Attainment of Migrants From Different Source Countries (*Predicted*)

		yrssch	
		migr	non-migr
HEAC	mean	1.72	1.22
	stddev	(0.27)	(0.25)
	N	4,567	8,238
US	mean	1.77	1.30
	stddev	(0.33)	(0.29)
	N	2,500	10,305
LEAC	mean	1.82	1.26
	stddev	(0.24)	(0.26)
	N	3,135	9,670

Notes: The descriptive statistics for the U.S. refers to the migrants and non-migrants observed in the data. For the LEAC and HEAC, in order to predict whether an individual is a migrant or not, the probability of observing that individual as a migrant is calculated using the parameter estimates from the reduced form two-step model for the U.S., given the characteristics of the individual. If this probability is greater than the proportion of migrants in the weighted sample for the U.S., then the individual is predicted to be a migrant; otherwise a non-migrant.

Individuals in the LEAC (HEAC) have 1.5 years less (more) schooling than the individuals in U.S.

APPENDIX 1 - IMMIGRATION POLICY OF CANADA

On October 2, 1967, Canada adopted new immigration regulations, which abolished the national origin quotas. Along with the changes introduced in the Immigration Act of April 10, 1978, the new system had four main categories of immigrants (Boyd, 1976, Green and Green 1995):

1. Independent
2. The refugee and humanitarian class
3. "Sponsored" dependents-husband, wife, fiancée, generally close relatives
4. "Nominated relative"—apply likewise to close relatives.

Today, the pool of applications for immigration is divided into two: Numerically unrestricted and numerically restricted. Numerically unrestricted category includes the "sponsored relatives" (dependent relatives) and refugee and humanitarian classes above. Numerically restricted category is composed of the remaining two classes: "Nominated relatives" and "Independent applicants". These two classes were about 50% of the total number of migrants admitted in 1990. Over 50% of the numerically restricted category are formed by migrants under Independent Class.

The applications under "independent" and the "nominated relative" classes are subject to the point system described below. The characteristics included in the point system aims to reflect the labour market conditions (e.g. occupational demand) as well as characteristics that are deemed important for long term success of immigrants (e.g. education).

When the point system was first established 50 points out of 100 was the minimum to get admission to Canada. On January 1st, 1986 this minimum was raised to 70 points (See Reimers and Troper, 1992 for details of the development of Canadian Immigration Policy since 1945).

The following table outlines the point system that was effective over 1986-1990:

Point System 1986-1990

Category	Potential Points
Education	12
Special Vocational Preparation	15
Experience	8
Occupational Demand	10
Arranged Employment/Designated Occ.	10
Age	10
Knowledge of French and English	15
Personal Suitability	10
Demographic Factor	10[28]
Total	105[29]

[28] Demographic factor (or levels) is set at 5 for everyone over the period we study. By setting different levels it is aimed to control the number of people entering over a period.

The number of points to be awarded for each factor in the point system, except the personal suitability, are determined according to a schedule.

Citizenship and Immigration Canada has a list of occupations that are in demand in Canada. This list is provided by Human Resources and Development Canada. Over the period 1986-1990 this was based on Canadian Classification and Dictionary of Occupations at the 7-digit detail. In 1997 the list was changed and is now based on National Occupational Classification. In order to be admitted the occupation of the prospective applicant must be on the list provided.

Specific vocational preparation (SVP) points depend on the amount of formal training required for average performance in that occupation. SVP value is determined from a list based on the Canadian Classification and Dictionary of Occupations at the 7-digit level.

The factor that can not be assessed from the paper screening is that of personal suitability, for which a maximum of ten units is available. This is the only subjective factor in the point system. The visa officer will make arrangements for an interview with the applicant where he considers the latter could meet the selection criteria, based on the information provided and the units the applicant could be awarded for personal suitability. If the information provided on the application form and accompanying documents clearly shows that an applicant will accumulate sufficient units of assessment to meet the pass mark, or, if applicants fail to accumulate sufficient units of assessment and have no chance of accumulating sufficient additional units during an interview, applicant will not normally be interviewed.

According to the immigration manual determination of the number of units of assessment to be awarded to an applicant rests on the judgement of the interviewing officer. The qualities of adaptability, motivation, initiative, resourcefulness, and such other attributes admirable or otherwise, as the applicant may display, are characteristics on which the officer may base his determination. Such characteristics on the part of an applicant's dependents may also be considered.

The fact that independent migrants fall under the numerically restricted category may raise concerns about the impact of numerical restrictions on the sample of migrants accepted. If, for example, due to numerical restrictions applicants with higher qualifications are accepted and other less qualified applicants who would be accepted in absence of numerical restrictions are rejected, this has to be taken into account as another selection process. We should however note that cut-off numbers are not country specific. Cut-off numbers are determined in terms of the aggregate number of migrants admitted. Secondly, number of people accepted in any given year differed from annual plans every year over the period 1979 to 1996.

[29] With the demographic factor set at 5, the maximum points possible from the characteristics listed is equal to 95. If the immigration officer decides to use his discretionary power he can award up to 10 points. This is different than the personal suitability. Use of discretion is very rare and nobody in our sample passed with discretion.

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